SOUTHERN AFRICA GLOBAL COMPETITIVENESS HUB

Technical Report:

Training Module on Quality Assurance Program

INCREASING THE VALUE AND QUALITY ASSURANCE FOR THE FRESH VEGETABLES AND HERBS SUPPLY CHAIN TO SUN INTERNATIONAL HOTELS IN ZAMBIA

by

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QUALITY ASSURANCE PROGRAM

Quality Assurance Systems

Introduction

Quality is an attribute that is required by many customers but the definition will depend on the customers' perceptions. **Therefore quality is the ability to meet agreed requirements or standards**. This is in addition to legislative requirements. An important aspect of a quality assurance system is the ability to show or demonstrate that a specific program has been followed and this is normally through documentation.

There are several attributes that are normally considered when demonstrating quality. The food product must be wholesome and safe and so food safety is an important requirement. There is also the area of nutritional value of the vegetable which is easy to demonstrate since vegetables are regarded as the main source of vitamins and minerals for the human diet. Some of the most visible and well know quality parameters are those associated with organoleptic factors such as taste, texture, smell and appearance. Many clients now have increasing questions about social and environmental issues and the producer has to meet those concerns.

Since customers have high quality standards, it is essential to try and meet their requirements otherwise they stop purchasing and the market is lost. A good quality assurance program is therefore necessary and the costs of implementing such a program must be budgeted for and regarded as a cost of business. This therefore increases the competitiveness of the producer. It also helps the producer become a more reliable supplier since overall management of the production enterprise is improved.

Characteristics of QA Systems

Generally a Quality Control program will have defined criteria with measurements to be followed (size, colour, etc). The producer will therefore have an activity to ensure all vegetables fall within the set criteria. Although the quality standards may be written down in a specific format, a good program should also focus on prevention of problems (before they occur) and this becomes a Quality Assurance program. The whole supply chain (from production to distribution) is therefore geared to follow the program. A good example is the question of pesticide residues. In order to eliminate them (a QC criteria may be 0% residues), the field operation involving pest control will have to be adjusted.

The first aspect of a QA program is the keeping of records of all activities of the production enterprise. This also allows for traceability of the product and the activities, especially where there may be questions about food safety or quality. A recording system has the advantage that it is easy to follow up on failures to ensure corrective action is taken and it does not happen again. It is also important to have specific personnel assigned to specific tasks and they take responsibility for those tasks. This is usually made easier if personnel are well trained and motivated and have a stake in ensuring a successful outcome.

The second aspect of a QA program is the use of third party auditing to ensure standards, activities and programs are being met. It is usual for the growers to have self-assessment questionnaires that they use to ensure corrective action is being taken. It is proposed that development agencies that have horticultural experience be involved in implementing the quality assurance program for smallholder farmers and to conduct training in this area. They may then be able to facilitate the inspection or auditing by more experienced organisations on a periodic basis. This is because the inspectors must be impartial and so will need to be different from the organisations providing support to the producers. Where large numbers of smallholders are involved, only a representative sample may be inspected provided the association can demonstrate good leadership and management in implementing the program.

The system to be implemented must be simple and easy to understand. There must be relevant and achievable targets. It must be flexible and cost effective. It should meet all legal and regulatory requirements. The program must be customer led and aimed at meeting the customers' expectations. The program should not look at the costs of implementation but the growers should have a long term outlook. All those involved in the program must therefore be fully committed to ensuring its success and having strong management skills usually helps this.

Growers involved in implementing a QA system must be well trained in areas such as hygiene, pesticide use and environmental matters so as to understand why they are important and how they fit into the program.

Policy Statement of Association

A statement must be made to describe the policy of the organisation, why it was set up and what it hopes to achieve. This clarifies the roles and objectives of the organisation and its members. This section may also indicate the agricultural practices and farming methods to be employed by the association and the ideal marketing practices to be followed.

Organisational Structure of Association

The structure of the organisation should be clearly stated so that all members understand it. This should include all necessary sections required for running an association but it should include a section that will be responsible for running a quality assurance program. This section will be responsible for developing a quality assurance manual and will be responsible for recommending or carrying out any sanctions against violators of the QA programme.

Quality Assurance Manual

The Quality Assurance manual for the farmers organisation shall have the following features.

1. Organisational policy and objectives of the quality control program.
2. Description of the agricultural practices and marketing system.

3. Risk assessment. Based on the information in (2) above, what are the main areas of risk and how are the problems to be avoided?
4. Organisational chart. Indicate the structure of the farmers association and the branches involved in implementing the quality control program.
5. Tasks and responsibilities of the Quality Control Committee.
    - Describe the operational structure of the committee including frequency and scheduling of meetings and reporting of minutes.
    - Schedule of inspections: how will this be done and by whom.
    - Response to non-compliance. How will this be reported and what action is to be taken.
    - Complaints monitoring. The committee will be responsible for receiving complaints about quality issues and formulating appropriated responses and implementing corrective action.
6. Personnel. It may be necessary to consider hiring of qualified personnel to run the quality assurance programme. The y will report directly to the Quality Control Committee and they should not be growers so as to avoid conflict. The two main jobs would be that of Quality Manager and Inspector.
7. Training and compliance. Describe what action is to be taken to improve the quality standards of the association through training and other activities.

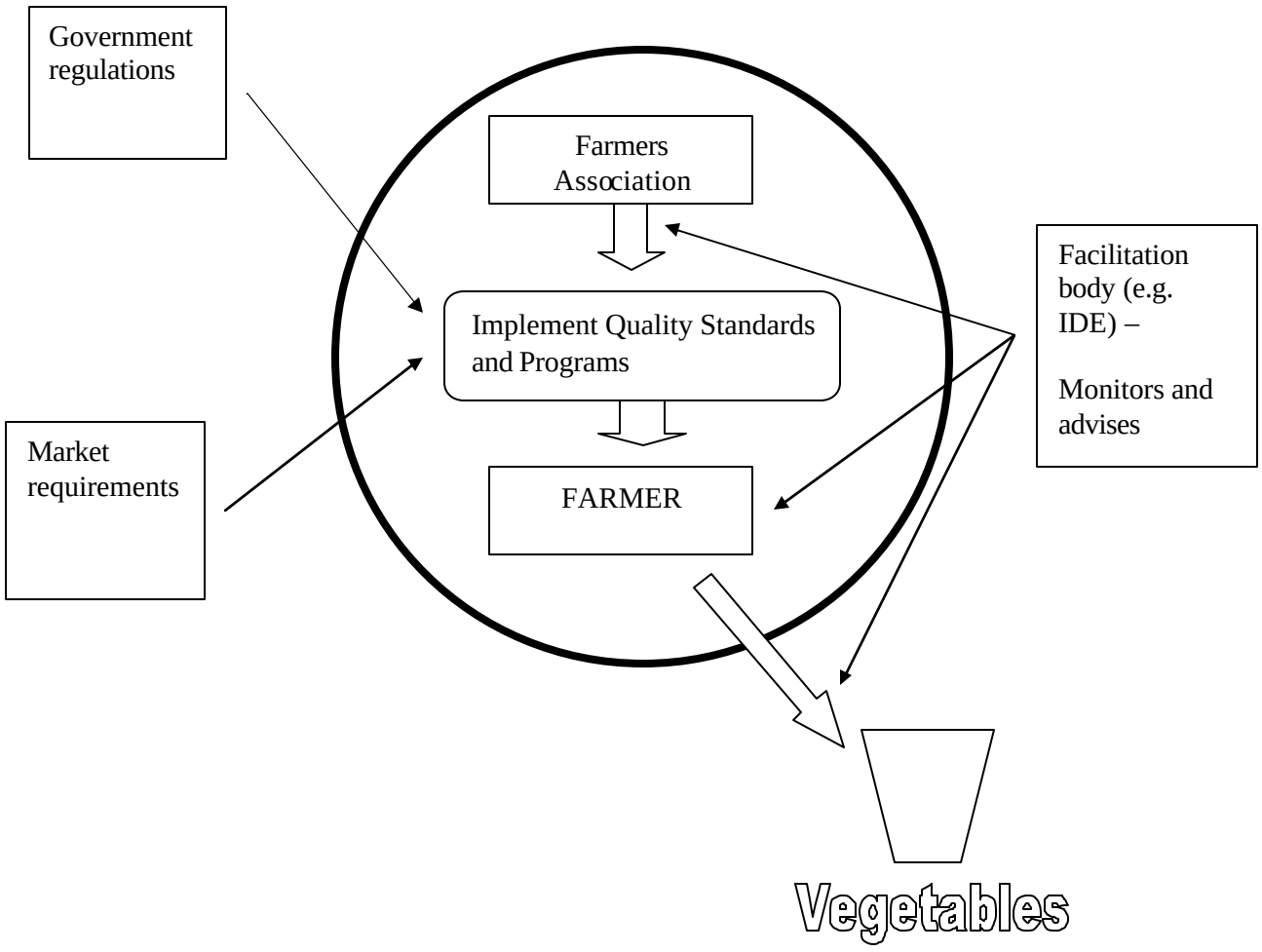
Hazard Analysis

The main dangers in quality assurance are the problems of poor grading and selection as well as the problem of hazards to human consumption. A hazard is any biological or chemical or physical property or condition of food which may cause it to be unsafe for human consumption. All possible sources of hazards should be identified and it is usually necessary to call in experts for this work. The risks (or the likelihood of a hazard occurring) should also be listed. In the handling and marketing of horticultural produce, problems can be due to food poisoning caused by infectious pathogens (e.g. *E. coli*) or fungal toxins (e.g. aflatoxin) and contamination of foods with chemicals such as pesticides. Food spoilage organisms that reduce the desirable characteristics of food may also be a problem especially where produce has been harvested but there is delay in getting it to market and it is stored under poor conditions.

Pathogens causing food poisoning can be found in human and animal wastes in dry or slurry form and so care should be taken when using manure slurries and teas to keep the manure off the produce and only in the soil. Faecal contamination of processing water or irrigation water is a danger and water should be tested and the source properly inspected. This can be a problem with salad vegetables. Physical hazards are mainly found because of poor handling and packing. The major problems would be sand, stones and other debris such as dead insects. Contaminants such as hair or even pieces of metal like nails from poorly constructed wooden crates or broken pieces of jewellery can found.

An example of the relationship between the quality assurance programme, the producers and the external environment is shown in the following diagram.

Structure for Implementation of Quality Assurance Program



The association will have to carry out a risk analysis exercise to determine all the potential points where a problem may occur. It is normally expected that external experts will be called in to conduct such an exercise and the assistance of ASNAPP and IDE will be very important for this activity.

Examples of occurrence of risk in vegetable production and marketing enterprise

Stage	**Risk**	**Action**
Farm level	Use of non-certified seed – may result in growing of disease susceptible varieties leading to increased diseases, lower yields and lower quality.	Listing of approved varieties and seed suppliers. Inspection of field records.
	Use of non-registered chemicals – results in pesticide residues on produce and increased disease incidence.	Spraying records inspected. Purchase of banned chemicals prohibited.
	No observation of harvest intervals – results in pesticide residues and danger of poisoning to consumers.	Spraying records inspected.
Harvesting	Use of unclean water for cleaning produce – results in microbial contamination and danger of water borne diseases to consumers.	Lab analysis of water sources. Treatment of water and treatment records available.
	Poor grading practice- results in poor quality presentation and lower prices.	Inspection of graded produce by association staff and inspection record sheets.
Transport	Poor packaging – results in increased damage and decay of produce, lower quality and lower prices.	Packing in sacks, bags and poor quality boxes to be prohibited.

Control Measures

The steps to be taken to eliminate or reduce the hazards are the control measures. There are various methods of control including elimination methods such as disinfection of equipment or treatment of water. These steps have to be used together with management methods such as maintenance of equipment and training programmes that prevent or reduce hazards from occurring. Good plant sanitation where wastewater is not used and care is taken with manure placement will help reduce food poisoning. Personal hygiene is very important and proper construction of toilets and hand washing will all help to avoid contamination with food poisoning organisms.

Contamination with pesticides can be avoided by following guidelines for good agricultural practices. The use of Integrated Pest Management methodologies will reduce the overall need for application of pesticides to growing crops. Good record keeping and good training will help in ensuring that harvest intervals are observed all the time.

Physical contaminants can be avoided with good management especially during grading and packing. Obs ervation of clean and hygienic practices, careful product

separation (from reject material) and use of high quality packaging will all reduce incidence of contamination.

Monitoring and Correction

The monitoring of the various activities to ensure that the quality programme is being implemented is a key component of quality assurance. Monitoring must be simple and quick so that fatigue does not set in. Monitoring should be able to detect a problem before it results in defective produce reaching the customer. Monitoring should therefore be a continuous process. It is also important to indicate what action will take place if something goes wrong. The defective product will need to be withdrawn but it may be diverted to other uses such as for stock feed. Where the problem is due to poor grading then the produce may be diverted to less stringent markets. Where the problem is due to pesticide contamination then the produce may need to be discarded.

Corrective action should include sanctioning of the offender especially where the infringement was deliberate (such as using a banned pesticide) and is likely to harm the reputation of the association. There is need for an investigation and a record of the incident made and a set of recommendations must be drawn up so as to prevent the problem from recurring. Corrective actions must be recorded and any changes in procedure noted.

It may be necessary to have some sort of verification of the quality of the produce and this can be done using shelf-life tests. A sample of the final product is retained for observation. If the customer complains about a quality problem that is not observed on the retained sample then there may have been a problem in transit or it may be a problem at the customers end. It is usually necessary to have independent audits of the whole quality assurance program so as to verify that there is proper implementation. This will check that the system is effective and may point to areas that were originally overlooked and can therefore be corrected.

Procedures and Work Instructions

Postharvest Handling and Packing

After produce has been harvested, it is removed from the field and taken to a central place for sorting, grading and packing. The handling facilities should provide shade to protect the vegetables from the sun. It should have a solid floor covered in concrete or straw. There should also be grading table for the sorting of the produce. All produce must free of contamination of microbial, chemical or physical hazards that can harm a consumer. The handling process should therefore eliminate these hazards and avoid introducing them on to the product.

The handling and grading process should therefore be clean and hygienic. During the harvesting operation in the field, the workers must first wash their hands before harvesting or after using the toilets so as not to contaminate any produce. Equipment, tools and containers coming in contact with the product must therefore be clean. The packaging material and the workers must be clean. Wooden crates must be clean and the wood should not be treated with preservatives. In order to reduce microbial

contamination during storage and transport, the product must be kept cool. Containers must not be used for anything else other than foodstuffs.

The grading shed must allow plenty of light in order to ensure that grading decisions and other activities are easy to implement. The building should be well ventilated and cool. Well constructed toilet facilities need to be provided for workers. Therefore hand washing facilities have to be in place for all those using the toilet. The work surfaces (e.g. grading tables and floors) must be kept clean. A cleaning schedule must be drawn up and cleaning records maintained. The area must be protected from insects, rodents and birds. Dogs and other domestic animals are not allowed in the packing area. Control of rodents may be necessary if they become a problem but rodenticide chemicals must not be allowed to come into contact with vegetables. The area should be kept clean so as to discourage pests.

Waste material such as old containers or packaging or equipment must not be kept near the packing area. Waste material from the grading process must be carefully disposed of using a covered container located in an opposite direction to the clean selected vegetables.

The persons involved in grading and packing must be healthy and operate in a hygienic manner including wearing clean overalls, washing of hands before packing, having short fingernails (this also reduces bruising of produce), covering their hair. All illnesses and wounds must be reported so that corrective action can be taken (e.g. covering minor wounds with waterproof plaster).

Sometimes there is need to wash the vegetables before packing them. The water to be used for this operation must be clean and potable (fit for human consumption) and if there are any doubts it must be tested for microbiological contamination at a recognised laboratory. Records of these tests must be kept. There may be need to check water quality on a seasonal basis. If there are problems then corrective action must be taken and this has to be recorded.

The growers association must keep good records of quantities of produce supplied by their members. This helps resolve disputes and it also helps ensure traceability if there is a problem. These records can include name of producer (or grower code) and date of delivery, vegetable type and variety, total number or weight of goods, temperature and condition of produce.

Delivery Procedures and Documentation

When produce is delivered to the client, there must be clear documentation leading back to the original grower. The association should have delivery register where the name of the producer, date of delivery, type of product, quantity and quality are recorded. The grower should retain a copy in case of any misunderstandings that may occur.

Safe Use of Chemicals

Introduction

Chemicals in agricultural production are used mainly for pest and disease control. There are however other important uses such as providing nutrients to plants. It is important to remember however that chemicals are dangerous. Some chemicals are highly poisonous to humans and therefore ALL chemicals should be handled very carefully. Many chemicals also have a detrimental effect on the environment and can harm animals and contaminate the soil and water.

Before any chemicals are used it is important to ensure that all regulations have been noted and are being followed. Only registered chemicals should be used. It is advisable to consult a qualified horticulturist or agronomist for recommendations on which chemical to use for specific tasks. It is important to remember that chemicals are poisonous. They can be absorbed into the body by breathing in the fumes. They can also get into the body through the skin. Chemicals should not be handled or applied by children or pregnant women, and preferably only by trained people.

Effective use of chemicals

An Integrated Crop Management and Integrated Pest Management program should be followed. This will help ensure that chemicals are used only when needed and in a cost effective manner. Priority should be given to alternative methods of weed, insect and disease control. It is necessary to have a scouting program in place for pest or disease problems. This will determine the best times to apply any chemical control measures and reduce the practice of routine spraying of pesticides or fungicides.

Good soil management will result in reduced loss of nutrients. Practices such as mulching, crop rotation and soil and water conservation all help improve soil fertility. Fertilizer recommendations should actually be based on soil sampling and analysis.

Chemicals should be mixed in an appropriate place that is well ventilated. Only the actual amount of chemical to be used should be mixed. Any material that is mixed and not used cannot be stored for use on another day, as it will have lost its efficacy by the end of the first day. If different chemicals are to be mixed then they should be compatible. It is always a good idea to test out a new chemical on a small area to find out how effective it is and if there are any phytotoxic effects.

Record Keeping

This is an essential part of any assurance program and good records will allow the producer to make timely management decisions and will also enable corrective action to be taken if something goes wrong. Records should be kept safe and should be made available for inspection if necessary.

The IPM program relies on the farmer taking good records of pest incidence in the field. If corrective measures are taken using chemicals then complete crop chemical

records are needed including amount used, crop/field sprayed and date and time information.

These records should also indicate who used the chemical and purpose of the application will give a pesticide application history of each field. These records will also help make it easier to follow the harvest interval requirements after the last application. Fertilizer usage is also recorded in the same way and will result in a fertiliser application history for each field.

Storage of Chemicals

Chemicals must be stored in a well constructed and secure room and warning signs placed at the entrance. There should be limited access to the chemical store, preparation areas and fields when spraying is taking place. The store must be located away from the homestead and must be kept locked at all times. It is important to keep herbicides, pesticides and fertilizer separate and the different groups well labelled. It is always a good idea to store chemicals in their original containers.

There should be a supply of dry sand and hydrated lime that can be used in cases of spillage or leakage. If there is a liquid spill, it must be covered immediately by lime, sand or even soil and the material collected for safe disposal in a sealed sump or pit. If chemical powders are spilled, they must also be covered by sand or soil before collection for safe disposal.

Handling of Chemicals

Chemicals need to be handled by people who have been trained and are aware of the risks and have knowledge of the proper procedures. Instructions on the label should be understood by all those concerned or involved in crop protection. Extra care should be taken during measurement of the required quantities and during preparation for spraying since there is a higher likelihood of accidental poisoning during these operations. The handler should wear protective clothing such as gloves, respirators, aprons, boots and overalls. These items must be cleaned regularly and kept in a separate and safe place when not in use.

Persons handling chemicals must be able to wash off immediately after they have finished their work. Water must be always available in cases of contamination as washing with water and soap is an effective method of reducing poisoning. Medical help must be obtained in all cases of suspected poisoning and contact details for medical assistance must be updated regularly.

Standards and Specifications

The following standards will be used for preparing the produce before delivery to the customer.

- Size. The vegetables will be of uniform size and separate size grades will be packed in separate boxes.

- Colour. The vegetables will be of uniform colour and maturity and the different colour grades will be packed separately.

- Blemish. The vegetables shall be free of all blemishes, bruises or disease scars or signs of damage by pests. Vegetables with minor scars (up to 5% of the surface) will be packed as a separate and lower grade.

- Taste. The varieties of vegetables to be grown will be selected on the basis of taste that is acceptable to the client. Agronomic activities must be implemented so as not to alter the taste characteristics required by the customer.

- Pesticide and Fungicide residues. The vegetables shall be free of all residues and they shall be produced using Integrated Pest Management techniques and all harvest intervals shall be followed.

- Packaging. The vegetables shall be packed in strong, durable, clean (and cleanable) containers that provide full protection to the contents.

- Labelling. The vegetables shall be properly labelled with the name of producer, production area or district, and date.

The product must have reached the required maturity level. They must have reached the required level of physiological development to enable ripening if this is necessary. They must be able to arrive at the market in a satisfactory condition. In all cases the product must be fresh and intact. The product must be sound, that is free of disease, rotting or deterioration. The product must be clean and free of any visible foreign matter and any foreign small or taste.

Classification

Extra Class: Vegetables in this class must be of superior quality. The shape and colouring must be characteristic of the variety. They must be packed in containers of uniform size and colouring. They must be free of defects with the exception of very slight superficial defects provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.

Class 1: The product must be of good quality and characteristic of the variety. However the following slight defects may be allowed provided these do not affect the general appearance of the produce, the quality and the keeping quality and presentation in the package.

- Slight defects in shape
- Slight defects of the skin due to rubbing or sunburn, suberized stains due to resin exudation and healed bruises.

Size to be determined by weight or by diameter. 10 % of the number of items may be outside of the stated size grade.

Presentation: The content of each package must be uniform and contain only the same variety, origin, quality and size.

Packaging: The packaging must protect the produce properly. The materials used for the packaging must be clean and any cushioning material must be new and must not cause damage to the produce.

Rejects and Corrective Actions

If there are deviations to the laid down procedures to the internal quality programme the association must have clear guidelines on what action is to be taken. The first requirement is that any irregularities must be recorded. The next step is to find out if any of the produce that has been affected has been sent to the client. This fact will determine the level of response required to correct the problem. If the produce has not been delivered to the client then a decision must be made about the rejected material. It may be suitable for the local market but if the problem is due to contamination by dangerous chemicals then the material must be destroyed.

The cause of the problem must also be investigated. This will help in formulating corrective procedures. It may simply be that the main intervention required is that of more training on a particular topic. It may be however that the problem is more severe (such as a contaminated water source) in which case the association should seek assistance from qualified people on how to proceed.

Environmental Management

The effects of agricultural operations on the environment are now an issue of concern to many consumers. The question of ensuring environmental sustainability has also been of concern to farmers. This is because environmental degradation has reduced the viability and productivity of crop production (e.g. the phenomenon of global warming and the rising frequency of droughts). It is therefore in the interest of smallholder growers to show they are producing responsibly as this will improve their marketing profile.

The main issues of concern in relation to environmental management are those of disposal of liquid and solid wastes. Wastewater from the cleaning of pest control and other equipment must be disposed of carefully. The production operation may also generate solid waste such as old containers of chemicals and other inputs, old or unrepairable equipment and packages. There may also be organic material that needs to be disposed (rather than being recycled as compost or fed to animals) such as diseased plants. All these need to be disposed of in a manner that does not cause soil or water pollution. Pollution may also be related to contamination of air (such as when spraying crop chemicals) and creation of noise, such as when using motorised pumping devices.

A good place to start when demonstrating environmental compliance is to follow all government and local council regulations regarding disposal of waste. There may be other regulations aimed at reducing soil erosion that will need to be followed such as using proper drainage and contouring. There may also be regulations relating to cutting of trees but the smallholders can also be proactive in demonstrating they are preserving natural woodland by using trees sourced from woodlots rather than indigenous trees.

The next step is to have a policy of minimising waste and recycling as much as possible. Some material can be removed from the farm by selling it to interested persons. There is also need for a proper site for disposal of material that cannot be recycled. The site should be well contained and confined. A good example is to have loose pieces of plastic and paper placed in a large plastic bag or box and this is then placed in a pit. This will prevent the pieces of plastic being blown around by the wind and will prevent water pockets that can encourage insects and rodents. If the material is to be burnt then a specific site has to be selected where this can be done safely.

It is very important to note that containers that were used for chemicals should be rendered unusable by puncturing large holes in them and flattening or destroying them. This will prevent them being used again for domestic purposes (for example carrying water or storing food) because these containers still retain traces of the original poisonous chemicals. These may then be buried or burnt.

A pit can be used to bury physical waste including empty containers. The pit should avoid water seepage to sources of ground water. A layer of clay and lime can be used to line the pit. It should be deep enough to prevent uncovering by humans or animals. During filling, the waste material can be mixed with layers of organic material or household waste so as to enable biodegradation. When it is full the pit should be covered with a compacted layer of earth and it must be clearly sign posted to avoid reuse of the site.

The above pit can also be used as sump for the disposal of water contaminated with chemicals or other materials. Sewage should be treated separately by using ventilated pit latrines or septic tanks. It is important to have records of all disposal activities including quantities, disposal methods, and dates.

Appendix 1. Delivery Records/Forms

Name of Receiving Station:

Farmer Code	Name of Farmer	Date	Crop (& type of variety)	Quantity	Comments (Quality/Defects)

Verification of Records:

Signature Manager

Date

Signature Supervisor

Date

Appendix 2. Spraying Records/Forms

Name of Farmer:			Farmer Code:	
Crop:			Field:	
Date	Chemical Applied	Purpose	Harvest Interval	Person Spraying

Signature of Supervisor:

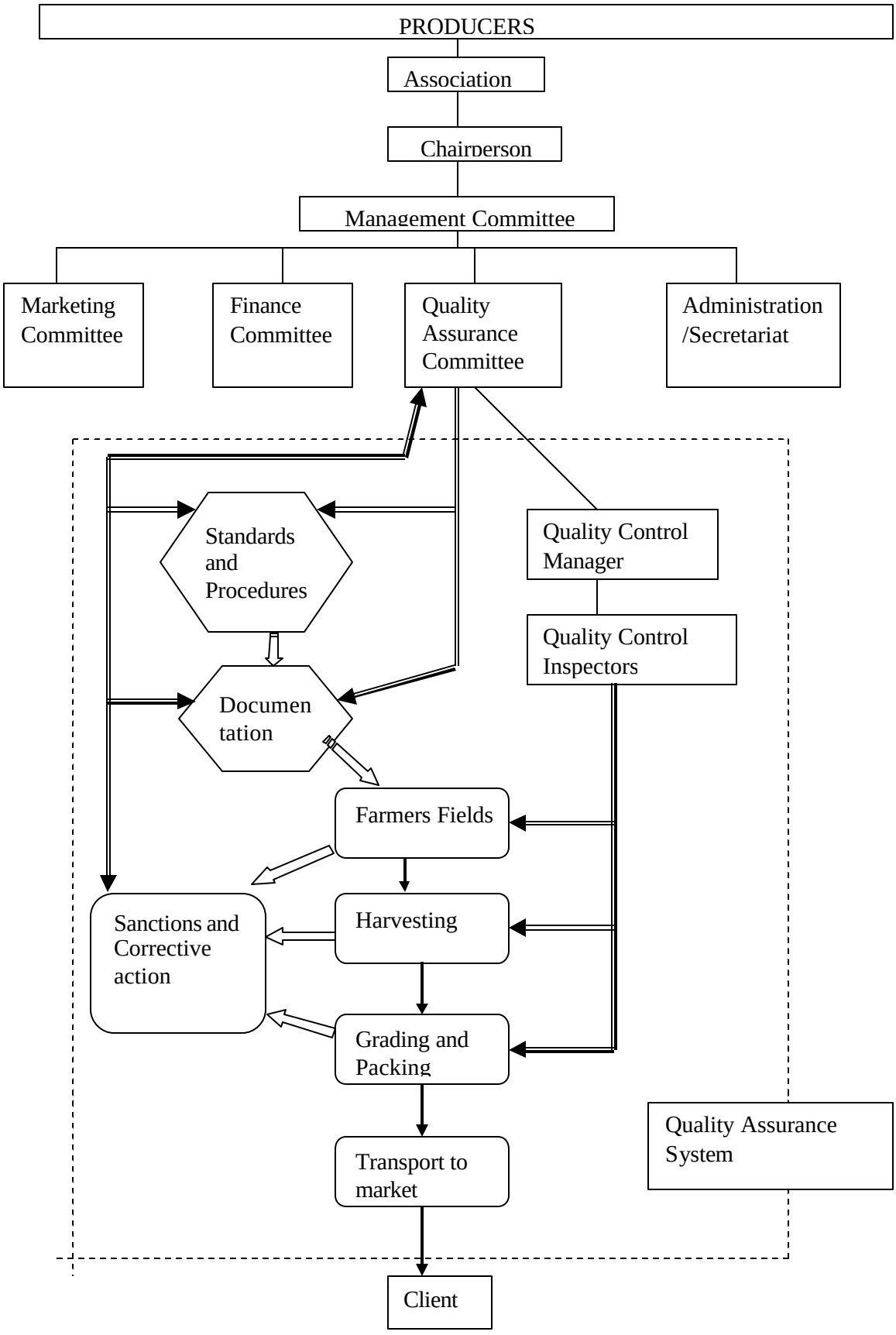
Date:

Appendix 3. General Farm Inspection Form

Name of Farmer & Farmer Code						
Name of Association						**Comments/Instructions**
Inspection date						
Date last inspection						
Fields visited						
Crop & variety						
Rotation	Y	N	G	F	P	
Land preparation						
Uses manure Fertilizer - type						
- kg						
Irrigation						
Water tests						
Chemicals store	Y	N	G	F	P	
Diseases observed - Control method						
Pests observed - Control method						
Weed control			G	F	P	
Garbage handling			G	F	P	
Grading shed			G	F	P	
Packing boxes			G	F	P	
Storage			G	F	P	
Cutting trees						
Toilets			G	F	P	
General score			G	F	P	
Farmer is implementing standards						
Farmer has violated standards						
Farmer has improved since last inspection						
Farmers Comments:						
Farmer to sign his agreement to this report						
Date Signature						
Inspector to sign his agreement to this report						
Date Signature						

Y=Yes, N=No, G=Good, F=Fair, P=Poor

Appendix 4. Organisation Chart



Appendix 5. List of banned or suspended agricultural chemicals

Pesticide Compounds Cancelled or Suspended by US Environment Protection Agency

acetamide-na
acrolein-can
acrylonitrile-c
alachlor-can
Alar
aldicarb-dd
aldrin-dd-b
allyl alcohol-c
alpha chlorhydrin-c
aluminum phosphide
amitraz-can
Amitrole
arsenic acid
arsenic trioxide-s
arsenic pentoxide-cna
Atrazine
avitrol-can
azinphos methyl
bendiocarb-can
benomyl
BHC-dd-b
bis (tributyltin) oxide
Brodifiacoum-c
copper oxychloride-c
coumaphos-na
creosote-c
creosote oil
cupric oxide-c
cyanazine-cna
cycloheximide-c
cyhalothrin-na
cyhexatin-b
cypermethrin
daminozide-s
DBCP-dd-b-c
DDD (TDE)
DDT-dd-b
demeton-c
diallate-c
dichloenil (2,4-D)
dichloropropene
diclofop methyl
dicofol
dicrotophos-cna
dieldrin-dd-b
diflubenzeron
flucythrinate-c
flouroacetamide-c
fluvalinate-c
fluoroacetamide
Fonofos-c
heptachlor-dd-s
hydrocyanic acid-c
Hydrogen cyanamide-na
imazaquin-c
isazofos-c
isofenphos-c
Kepone
lead arsenate-b
Lindane-dd-b
magnesium phosphide
metaldehyde
methamidophos
methiocarb
methomyl-cna
methyl bromide-cna
Methyl parathion-dd
mercury compounds-b
mevinphos-c-b
picloram, isooctyl ester-c
picloram, potassium salt-cna
picloram, triisoprpanolamine
polychlorinated terphenyls
potassium pentachlorophenate-c
pronamide
profenphos-na
propanoic acid
safrole-b
silvex-b
simazine
sodium arsenate-s
sodium arsenite-b
sodium cyanide
sodium dichromate
sodium fluoroacetate-cna
sodium fluoride
sodium methyldithiocarbamate
sodium monofluoroacetate
sodium pyroarsenate-c
strobane-b
strychnine
sulfotep-cna

bromoxynil
bromoxynil butyrate-b
butylate-c
cadmium-b
cadmium chloride-c
calcium arsenate-b
calcium cyanide-c
captafol-b
captan
carbofuran-s
carbon tetrachloride-b-c
chloranil-b
chlordane-dd-b
Chlordimeform-dd-b
Chlorfenvinphos-c
chlorbenzilate-b
Chlorophacinone-cna
Chloropicrin
Chlorothalonil
chromic acid
coal tar-can
coal tar creosote
copper arsenate-b
dimethoate
dinocap
dinoseb-b
dioxathion-cna
diphacinone-c
disulfoton
dodemorph-c
E-mevinphos-c
endrin-dd-cna
EBDCs
EDB-dd-b
endrin-cna
EPN-c-b
EPTC
ethion-cna
ethoprop-cna
ethyl parathion-cna
ethylene dibromide-c
fenamiphos-cna
fenitrothion-cna
fensulfothion-c
fenthion
fenvalerate-cna
mirex-b
monocrotophos-c-b
niclosamide-cna
Nicotine
Nitrogen, liquid-na
Oxamyl-na
oxidemeton methyl-cna
OMPA-b
10,10' oxybisphenoxarsine
oxyfluorfen
parathion-dd
paraquat-dd
PCBs
PCNB
pentachlorophenol-dd-cna
pentachlorophenol-sodium S-dd-cna
permethrin
phenarsazine chloride
Phorate-cna
phosacetim-c
phosalone-c
phosphamidon-c
Picloram-c
sulfuric acid
sulfuryl fluoride
2,4,5-T-dd-b
2,4,5-TCP-b
tefluthrin
TEPP-c
terbufos-na
tergitol-c
TFM-na
thallium Sulfate-b
TOK (nitrofen)-b
toxaphene-dd-b
tributyltin fluoride-cna
tributyltin methacrylate
tributyltin-s
trifluralin-c
triphenyltin hydroxide
vinyl chloride-b
z-mevinphos-c
zinc phosphide
Wood Preservatives: calcium arsenate-b, creosote, pentachlorophenol-dd, sodium arsenate-b, and sodium arsenite-b

na = chemicals with no active registered products
cna = chemicals with cancelled and no active registered products
c = chemicals with all products cancelled
b = chemicals with all products banned
s = chemicals with most uses strictly restricted
Dd = "dirty dozen" pesticides as designated by PAN, in Boldface Type

Source: USEPA 2002